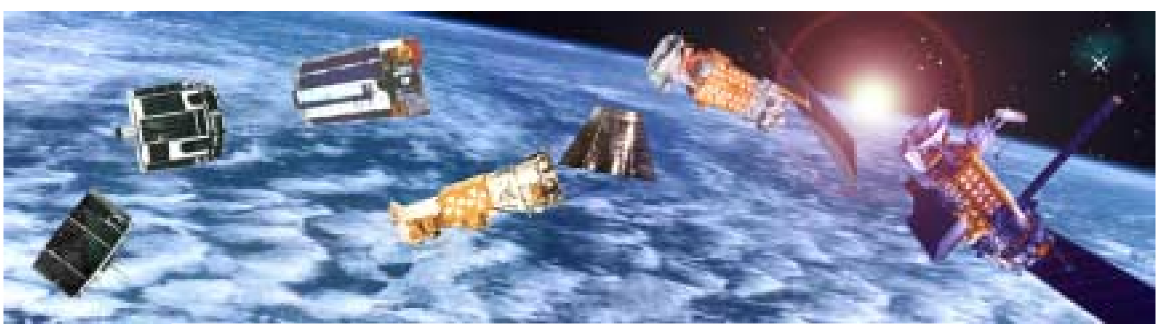
Department of Defense Communication Satellites

The SMC Heritage Center

During the second half of the twentieth century, the organization now known as the Space and Missile Systems Center introduced two revolutionary applications of technology—strategic missiles and artificial satellites—into the arsenals of America and its allies. The new military capabilities had a heavy influence on the outcome of the strategic confrontation called the Cold War, and on achieving other critical national goals as well. To create those capabilities, the organization managed the research, development, procurement, testing, and early on-orbit control of most of the nation's military space and missile systems. Until about the middle of the 1980s, it also managed the launch and continuing on-orbit control of most military and many civilian systems. SMC, its predecessors, and cooperating agencies built up a remarkable history of managerial and technological accomplishments in carrying out those responsibilities.

Through the photographs, models, and words on display in the lobby of Building 105, we bring some of that history to SMC's staff and visitors to help them understand the present and plan for the future. The graphics were developed as a joint project by SMC's History Office, SMC's Directorate of Plans and Programs, and the 61st Communications Squadron's Photo Lab and Art Services Office. The pictures came from SMC's historical archives and from the Fort MacArthur Military Museum of the City of Los Angeles.



Meteorological Satellites

Air Force Launch Vehicles

The three people most directly responsible for the success of the early Air Force Strategic missile programs: Trevor Gardner (Assistant Secretary of the Air Force for Research and Development), then-Maj Gen Bernard A. Schriever (commander of the Western Development Division), and Dr. Simon Ramo (CEO of the Ramo-Wooldridge Corporation).

Early Air Force Ballistic Missile Programs

Faced with growing evidence of the Soviet Union's development of thermonuclear weapons and ballistic missile technology in 1953, the Air Force Secretariat's architect for R&D, Trevor Gardner, chartered the Strategic Missiles Evaluation ("Teapot") Committee, chaired by Professor John von Neumann, to diagnose the slow pace of America's strategic missile programs. The Committee recommended in 1954 that Project Atlas, the only American ICBM then under development, be reoriented and accelerated. The Air Force established the Western Development Division to carry out that task, sending Brigadier General Bernard A. Schriever to Los Angeles to set up and command the new organization in August 1954.

At first, the Division was responsible for developing only the Atlas, which was being designed and built by the Consolidated Vultee Aircraft Corporation (Convair). It was an intercontinental ballistic missile with liquid fuel engines and a stage-and-a-half configuration. Within a year, the Division also became responsible for developing an alternate missile called the Titan. A more advanced, two-stage missile to be built by the Martin Company, the Titan was a hedge against failure or delay in the Atlas program. By the end of 1955, the Division was also developing an intermediate range ballistic missile, the Thor, under contract to Douglas Aircraft Company. Finally, it was charged with achieving initial operational capability for the three missile systems. That meant deploying them, a massive undertaking in itself. In barely 18 months, the mission of the Division had undergone an enormous expansion.

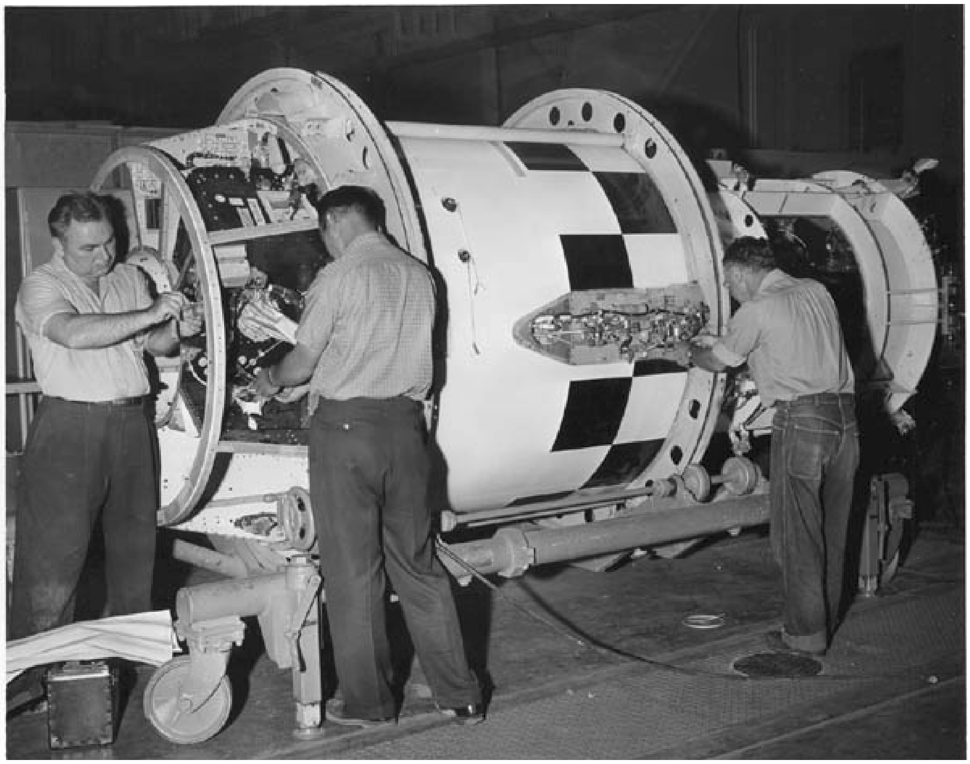
To develop operational missile systems as soon as possible, the Division replaced the conventional pattern of sequential development with concurrent development. Within the framework of a single overall plan, tasks related to development, production, testing, and initial operational capability proceeded simultaneously. Although the concept of concurrency was not new, the Division applied it on a scale never before used in military development programs.

The development of ballistic missile systems slowed in 1956-1957, when the Eisenhower administration made large cuts in defense spending to balance the budget. Then, on October 4, 1957, the Soviet Union used an ICBM to launch the first man-made satellite. Sputnik's impact was dramatic. The US missile program was given renewed impetus, restrictions were lifted, previous program priorities were reinstated, and funding was vastly increased.

On September 20, 1957, even before Sputnik, the Air Force Ballistic Missile Division successfully launched a Thor missile from Cape Canaveral, Florida. On December 17, the Division carried out the first successful Atlas launch, also from Cape Canaveral. Following these successes, the Air Force missile program progressed rapidly. Deployment of the Thor was completed in 1960 at four 15-missile Royal Air Force squadrons in England. By the end of 1962, 132 Atlas launchers had been turned over to SAC squadrons by Ballistic Systems Division’s Site Activation Task Forces (SATAFs). The Titan made its first successful flight in 1959, and the SATAFs turned over all 54 Titan I launchers to SAC during 1962. By the end of 1962, therefore, all three first-generation missiles were in place and ready for operation.

Atlas 4A, the first Atlas R&D missile to be launched, soars briefly into the air at Cape Canaveral on 11 June 1957.

The first SAC launch of an Atlas missile (Atlas 12D) takes place at Vandenberg AFB on 9 September 1959. SAC then declared the Atlas weapon system operational



Agena A 1057 for Discoverer XIII is checked out by Air Force and Lockheed technicians before launch on 10 August 1960. Its reentry capsule provided the first successful recovery from orbit

Agena

The Agena spacecraft was one of the most versatile, useful, and long-lived creations of America's early military space effort. It was named for a star used by navigators to find the South Pole, the intended direction of Agena launches from Vandenberg AFB. Lockheed designed and produced the first version (the Agena A) under contract to SMC's organizational ancestor, the Western Development Division. It was part of the development package for the first Air Force satellite program, known as Weapon System 117-L, for which the Agena was to be both an upper stage and a space platform. However, several satellite programs of enormous strategic importance depended on it, not only to achieve their proper orbits, but also to maneuver, operate, and sustain their payloads during their operational lifetimes. In one version or another, Agenas were used in over 360 military and civilian launches for almost the first 30 years of American space flight. They provided propulsion and on-orbit support for such military programs as Discoverer/Corona, MIDAS, SAMOS, and Vela; and for NASA programs such as Ranger, Mariner, Lunar Orbiter, Gemini, and the Orbiting Astronomical Observatory.

The Agena established many early spacecraft records. While hosting Air Force payloads, it became the first spacecraft to achieve a nearly circular orbit, the first to enter a polar orbit, the first to change and maintain its attitude in orbit, the first to stabilize itself on all three axes in orbit, the first to successfully eject capsules from orbit for return to earth, and the first to restart its main propulsion unit in orbit. With NASA payloads, it became the first spacecraft to change orbits, the first to fly by the planet Venus, the first to fly by the planet Mars, and the first to accomplish a rendezvous and docking of two spacecraft in orbit.

Agenas were developed and produced in three major, successive variations: A, B, and D. The **Agena A**, used from 1959 to 1961 with Thor and Atlas launch vehicles for the early Discoverer/ Corona, MIDAS, and SAMOS programs, was a valued (though, at first, flawed) spacecraft, but it was limited by the fact that its Bell 8048 liquid-fuel engine could not be restarted in orbit. Furthermore, it had no solar cells to generate power, so that its working lifetime in orbit was limited by the duration of its batteries. The **Agena B**, used with Thor and Atlas vehicles for a wide variety of military and civilian payloads from 1960 to 1966, added two valuable innovations. First, it could be outfitted with deployable solar panels to generate its own electrical power in orbit. Second, its Bell 8081 liquid-fuel engine could be ignited to achieve a desired initial apogee, shut down to coast, and then restarted to raise the craft's orbital perigee or change its interplanetary trajectory. The **Agena D**, first launched in 1962, was in regular use far longer than the previous configurations. It was used with Titan IIIB as well as Thor and Atlas launch vehicles. Its main engine was capable of multiple restarts, and it could be outfitted with auxiliary thrusters to carry out minute corrections in orbital position and velocity.

The display features 1/8th scale models of the Agena A (bottom) and Agena B (top), the pioneering spacecraft of early military space programs. The Agena A is shown in an orbital attitude (imagining the earth at the bottom of the display case) in which it carried the Discoverer/Corona photographic reconnaissance payloads. The Agena B, with deployed solar panels, is shown as it would be positioned in orbit to operate the MIDAS infrared surveillance payloads. In the background are a 1/19th scale model of a **Thrust-Augmented Thor/Agena D** and a 1/20th scale model of an **Atlas/Agena D** in configurations used during the 1960s.

An Agena A spacecraft with the first MIDAS payload is prepared for mating to Atlas 29D at Cape Canaveral in February 1960.

Agena B 1061 for Discoverer XVI is prepared for integration and launch on 26 October 1960. This was the first use of an Agena B.

The first Thor Agena A launch vehicle (Thor 163 with Agena 1022) sits on Pad 75-3-4 at Vandenberg AFB before launching Discoverer I on 28 February 1959.

Early Air Force Launch Vehicles

The earliest launch vehicles used by the Air Force were **Thor** and **Atlas** missiles modified to serve as space boosters. Indeed, the Air Force achieved its first success in space with Project Score, an Atlas B missile containing communications equipment in its avionics pods. The entire missile was placed into orbit on 18 December 1958. Thor and Atlas missiles with minor modifications continued to be used as space boosters for a long time, especially for military and civilian weather satellites. The last Thor launch occurred in July 1980, and the last launch of a modified Atlas missile occurred in March 1995, with both boosters carrying military weather satellites. As time went by, Thor and Atlas vehicles were improved and standardized, and families of Standard Launch Vehicles were created. The Thor gave rise to the series known as **Standard Launch Vehicle 2**, and the Atlas gave birth to the several varieties of **Standard Launch Vehicle 3**. Upper stages such as the **Agena**, the **Burner II**, and the **Stage Vehicle System** were developed for use with these vehicles. Together with their associated upper stages, Thor and Atlas launch vehicles once constituted the backbone of the US space program.

These launch vehicles were developed by the Ballistic Missile Division and its successors. They were used not only by the Air Force but also by the National Aeronautics and Space Administration, created in 1958. Civilian programs began using boosters based on the Thor missile immediately, and in 1959, NASA began developing the **Delta** upper stage for it—

the first step in developing the highly successful Delta launch vehicle. NASA started using the Atlas vehicle in 1959, and its first manned space program, Project Mercury, relied on the Atlas for its orbital flights. Project Gemini, the agency's next manned program, employed **Titan II** boosters developed and procured by Space Systems Division. The Gemini Target Vehicle, an Agena upper stage, was also developed by Space Systems Division. The Agena was later modified by NASA and employed extensively by both agencies. The **Centaur** upper stage, the most powerful upper stage in the national inventory, was born as an Air Force program before being transferred to NASA in 1960. It is noteworthy that much of this cooperation in developing and using launch vehicles was the result of a carefully considered series of written agreements—initiated in 1959 and expanded during the early 1960s—which made up a National Launch Vehicle Program.

Thor and Atlas boosters were soon complemented by the **Titan III,** a powerful booster capable of launching large, heavy payloads. Development of the Titan III was initiated in late 1961, and the first research and development vehicle was flown in September 1964. This vehicle, a Titan IIIA, consisted of a modified Titan II core topped by an upper stage called the **Transtage**. A new configuration, the **Titan IIIC**, was successfully launched from Cape Canaveral in June 1965. The IIIC used two strap-on solid rocket motors that generated around one million pounds of thrust each. From 1965 through 1989, Titan III vehicles performed well in a wide variety of missions and configurations. The family expanded to include the **Titan IIIB/Agena D**, the **Titan IIID**, and the **Titan IIIE/Centaur**, which was used by NASA for space projects such as the Viking missions to Mars. The final variety of Titan III, the **Titan III (34)D**, was used during the 1980s as a backup and alternative to the manned Space Shuttle. The last 34D was launched in September 1989.

The first Atlas Agena combination rises from Launch Complex 14 at Cape Canaveral on 26 February 1960. It attempted unsuccessfully to launch MIDAS I, the first missile detection satellite

The first Atlas/Centaur combination (Atlas 104D with Centaur AC-1) rises from Launch Complex 36A at Cape Canaveral on 8 May 1962. The Centaur exploded 55 seconds late

The 16th DSP satellite and its IUS upper stage in the cargo bay of the Space Shuttle just prior to deployment on 24 November 1991. This was the only DSP satellite to be launched on the Space Shuttle.

Early Reconnaissance and Surveillance Satellites

The first Air Force satellite program was known as the Military Satellite System, or **Weapon System 117L**. SMC's organizational ancestor, the Western Development Division, received responsibility for it in February 1956. By the end of 1959, WS 117L had evolved into three separate programs—the Discoverer/Corona Program, the Satellite and Missile Observation System (SAMOS), and the Missile Defense Alarm System (MIDAS). Discoverer and SAMOS developed satellite systems for photo reconnaissance, while MIDAS developed a space-based missile warning system using infrared detection.

Publicly, **Discoverer** was an experimental program to develop and test satellite subsystems and explore environmental conditions in space. Secretly, under the code name **Corona**, the program used film-return photo reconnaissance satellites to provide intelligence imagery about the Soviet Union from space. Such imagery filled a crucial need, especially after President Eisenhower suspended aerial reconnaissance of the Soviet Union in 1960. The film from corona satellites re-entered the atmosphere in a capsule with a parachute. It was recovered either in mid-air or in the ocean.

Despite initial failures, Discoverer achieved many significant breakthroughs in space flight. Discoverer provided the world's first polar orbiting satellite; the first satellite to be stabilized in orbit on all three axes, to be maneuvered on command from the earth, and to send a reentry vehicle back to earth; the first deliberate recovery of an object ejected from an orbiting satellite; and the first aerial recovery of an object returned from orbit. In August 1960, the capsule from Discoverer XIV became the first to return film from orbit.

The **Satellite and Missile Observation System** (SAMOS), the second program that evolved from WS 117L, aimed at developing a heavier reconnaissance satellite that would be launched by an Atlas booster rather than the Thor used to launch the Discoverer. SAMOS had two launches: one in October 1960, which failed, and one in January 1961, which was successful. In 1962, a veil of secrecy was drawn across the SAMOS program, and the Air Force stopped releasing information about it. Unlike the Corona program, it has never been declassified.

The **Missile Defense Alarm System** (MIDAS) program developed satellites that carried infrared sensors to detect hostile ICBM launches. The first MIDAS satellite, launched in February 1960, failed to achieve orbit. MIDAS II, launched in May 1960, did achieve orbit, but its telemetry system failed two days after launch. MIDAS III, successfully launched in July 1961, also achieved orbit and was the heaviest US satellite launched up to that time. MIDAS eventually evolved into the **Defense Support Program** (DSP), whose mission was declassified following the Persian Gulf war of 1991. Today, the satellites, ground stations, and mobile ground terminals of DSP perform MIDAS's original mission of detecting and reporting on hostile missile launches.

Nuclear surveillance was first performed by six pairs of **Vela** satellites placed into orbit between October 1963 and April 1970. These satellites were used primarily to monitor the 1963 Nuclear Test Ban Treaty, but they also provided important scientific data on solar flares and on other radiation that could affect man's safety in space. Eventually, Vela's mission was performed by additional sensors on host spacecraft.

Arrival of Discoverer XIII capsule, the first successfully recovered, at Andrews AFB on 13 August 1960. Left to right: Col "Moose" Mathison (commander of 6594th Test Wing), who brought the capsule; Maj Gen Osmond J. Ritland (commander of Air Force Ballistic Missile Division); Lt Gen Bernard A. Schriever (commander of Air Research and Development Command); and two civilian officials.

Vela satellite from first pair launched on 17 October 1963. Left to right: Dr. William J. Chalmers of TRW's Space Technology Laboratories; Col Lonnie Q. Westmoreland, program director at Space Systems Division; and Stanley S. Strong of the Aerospace Corporation.

This artist's concept depicts a Milstar I satellite in orbit.

Communications Satellites

The world's first communications satellite was launched by the Air Force Ballistic Missile Division, SMC's predecessor, in December 1958. **Project SCORE** consisted of communications equipment built by the ArmySignal Corps installed in an Atlas B missile, which AFBMD launched into orbit whole.

The first operational military satellite communications system was known as the **Initial Defense Communications Satellite Program** (IDCSP). It consisted of 100 pound satellites launched in clusters. Twenty-six satellites were placed into orbit in four launches between June 1966 and June 1968, providing a usable worldwide communications system for the Defense Department. The **Defense Satellite Communications System, Phase II** (DSCS II) satellites were much larger than IDCSP satellites and offered increased communications capacity, greater transmission strength, and longer lifetimes. In addition to wide area coverage, they provided intensified coverage of small areas by using steerable antennas. Sixteen DSCS II satellites were built and launched into geosynchronous orbits from 1973 to 1989. DSCS III satellites carry multiple beam antennas to provide flexible coverage and resist jamming, and they offer six active communication channels rather than the four offered by DSCS II. The first DSCS III satellite was successfully launched in October 1982, and a full constellation of five satellites was completed in July 1993.

The 1,600 pound **Tactical Communications Satellite** (TACSAT), launched in February 1969, operated in both ultra high frequency and super high frequency. It tested the feasibility of communications with mobile equipment for ground, naval, and air forces. The **Fleet Satellite**

Communications System (FLTSATCOM) was the first operational system serving tactical users. The Navy managed the overall program, but SAMSO developed the satellites. Five FLTSATCOM satellites were successfully launched between February 1978 and August 1981. Three replenishment satellites were launched between December 1986 and September 1989, but one was lost when its booster was hit by lightning.

SMC's predecessors developed other communications satellites for allied nations. The **Skynet** program provided the United Kingdom with its first military communications satellite system. Skynet I was launched in November 1969, and a more advanced Skynet II, in November 1974. Skynet and **NATO** satellites were designed to be compatible with each other and with DSCS. One NATO II satellite was placed into orbit in March 1970, and another, in February 1971. Three NATO III satellites were successfully launched between 1976 and 1978, and a fourth in November 1984.

SMC manages the acquisition of the **Milstar** system. Milstar I satellites carry a low data rate payload that provides worldwide, survivable, highly jam-resistant communications for the National Command Authority and mobile forces. The first Milstar I was successfully launched in February 1994, and the second, in November 1995. Milstar II satellites will carry both low and medium data rate payloads, increasing the ability of theater forces to communicate within and across theater boundaries. Unfortunately, the first Milstar II satellite went into an unusable orbit in April 1999.

The completed Tactical Communications Satellite (TACSAT) undergoes testing at Hughes Aircraft Company in !969. It was successfully launched (February 1969

The payload fairing is installed on Titan IIIC-16 at Cape Canaveral. Enclosed are the last 8 satellites of the Initial Defense Communications Satellite Program (IDCSP), successfully launched on 13 June 1968.

DMSP Block 5C satellite mated to Thor Burner IIA launch vehicle during addition of payload fairing at Vandenberg AFB, about 1972-1976.

Weather and Navigation Satellites

The **Defense Meteorological Satellite Program** (DMSP) maintains a constellation of at least two weather satellites in polar orbits about 450 miles above the earth. Space Systems Division began development and deployment of weather satellites and associated ground stations and weather terminals during the 1960's. The system made its first major contribution during the Vietnam conflict, when data from weather satellites was used to plan air operations. Since then, all elements of the system have been upgraded repeatedly. The Block 5D-2 and 5D-3 satellites currently in orbit carry primary sensors that provide images of cloud cover over the earth's surface during both day and night, and they carry other sensors that provide additional types of data on weather and on the space environment. All this information is supplied to the armed services to support military operations and to the National Oceanic and Atmospheric Administration (NOAA) to support civilian weather forecasting. NOAA and DOD will soon combine their meteorological systems into the National Polar Observation and Environmental System (NPOES).

The **Global Positioning System** (GPS) consists of satellites that broadcast navigation signals to the earth, a control segment that maintains the accuracy of the signals, and user equipment that receives and processes the signals. By processing signals from the nearest four satellites, a user set is able to derive its own location in three dimensions.

GPS had two ancestors in the late 1960s: a technology program called **621B**, started by SAMSO and the Aerospace Corporation, and a parallel program called **Timation**, undertaken by the Naval Research Laboratory. Program 621B envisioned a constellation of 20 satellites in synchronous inclined orbits. Timation envisioned a constellation of 21 to 27 satellites in medium altitude orbits, and it even launched three prototype satellites. In 1973, elements of the two programs were combined into the GPS concept, which employed the signal structure and frequencies of 621B with medium altitude orbits similar to Timation.

The Deputy Secretary of Defense authorized the GPS program to start in December 1973. During the validation phase, four Block I navigation satellites and a prototype control segment were built and deployed, and development models of user equipment were built and tested. During the development phase, additional Block I satellites were launched to maintain the initial satellite constellation, a qualification model Block II satellite was built and tested, and manufacture of additional Block II satellites began. In addition, an operational control segment was activated, and prototype user equipment was developed and tested. During the production phase, a full constellation of 24 Block II and IIA satellites was deployed, and user equipment was produced, issued to foot soldiers, and installed in ships, submarines, aircraft, and ground vehicles. The full constellation of 24 Block II and IIA satellites was completed in March 1994, allowing the system to attain full operational capability in April 1995. The system supports a wide variety of military operations, including aerial rendezvous and refueling, all-weather air drops, instrument landings, anti-submarine warfare, bombing and shelling, photo mapping, range instrumentation, rescue missions and satellite navigation. It is also the focus of a growing civilian market for GPS applications.

A GPS Block I satellite undergoes acceptance testing at Arnold Engineering Development Center

A soldier holds one of the Small Lightweight GPS Receivers (SLGRs) used during Operation Desert Storm in 1991.

An Atlas IIA Centaur (AC-118) successfully launches the DSCS III satellite B7 from Cape Canaveral on 31 July 1995

Later Air Force Launch Vehicles

In 1967, NASA began to develop the manned Space Shuttle to replace most expendable launch vehicles. SAMSO contributed several important elements to allow DOD to make full use of the system. It built a launch and landing site at Vandenberg AFB to allow the Shuttle to use polar orbits, and it developed the **Inertial Upper Stage** (IUS) for large Shuttle payloads requiring higher orbits. The IUS was also adapted for the Titan III and Titan IV launchers. In January 1986, a Space Shuttle exploded during launch, killing the crew of the orbiter *Challenger*. NASA suspended all Shuttle launches while it investigated the cause of the explosion and assessed its implications. Military and civilian payloads scheduled for the Shuttle had to obtain expendable boosters or wait. Shuttle flights resumed in September 1988, but development of the Shuttle facilities at Vandenberg ended because design changes in the Shuttle diminished its capability for polar launches.

The Titan program happened to be suffering from launch failures of its own when the *Challenger* disaster occurred. After consecutive launches of **Titan 34D**s failed in August 1985 and April 1986, further launches were suspended while the causes were investigated. They resumed in October 1987, restoring the only available alternative to the Space Shuttle for large payloads. Fortunately, Space Division had already begun the development of a larger, more capable Titan booster known as the **Titan IV** in 1985. First launched in June 1989, the Titan IV could be used with either an IUS or a newly developed version of the Centaur upper stage. It could place 10,000 pounds into geosynchronous orbit using the Centaur, and its performance was improved by upgraded solid rocket motors, which completed their final test firing in September

1993. For some smaller payloads, Space Division began converting the 55 obsolete **Titan II** ballistic missiles removed from their silos. They could place about 4,200 pounds into low-earth, polar orbit, and the first was launched in September 1988.

During the suspension of Shuttle flights, Space Division also began to buy two new medium launch vehicles. Development of the **Delta II**, an improved Delta launch vehicle, began in January 1987. Its primary mission was to launch the constellation of 24 operational Global Positioning System (GPS) satellites, beginning in February 1989. Until the constellation was completed in March 1994, a Delta II successfully launched a GPS satellite about every two months. Development of the **Atlas II**, an improved Atlas/Centaur launch vehicle, began in June 1988. It could launch somewhat heavier payloads, such as the Defense Satellite Communications System (DSCS) and some experimental satellites, and it was used in many commercial launches. The Atlas II launched its first commercial payload in December 1991 and its first DSCS satellite in February 1992
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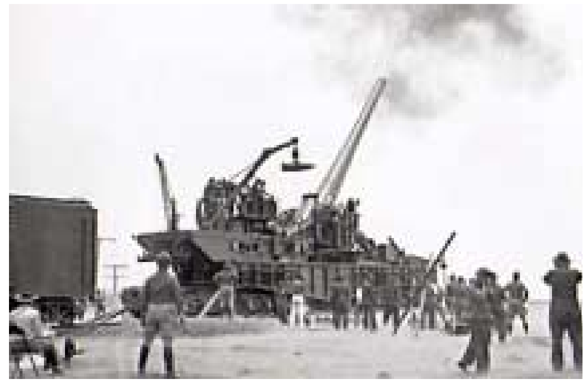
During the late 1980s and early 1990s, the Air Force and NASA made several unsuccessful attempts to procure a more efficient family of launchers to replace the Space Shuttle and expendable launch vehicles. A program finally got under way after President Clinton signed a National Space Transportation Policy in August 1994. It assigned responsibility for expendable launch vehicles to DOD and directed it to prepare for the evolution of a new expendable vehicle. The response was SMC's Evolved Expendable Launch Vehicle (EELV) program, which proposed to develop a family of launch vehicles for medium to heavy payloads based on existing vehicles or their components. SMC awarded contracts for the initial phase of the EELV program in August 1995.

A Titan IV rocket with an IUS upper stage (IUS-20) lifts off from Cape Canaveral on 22 December 1994, successfully launching the Defense Support Program's DSP-17 satellite.

A Delta II booster successfully launches GPS II-10 from Cape Canaveral on 26 November 1990.

Sight-setter on a 14" disappearing carriage rifle about 1930. When the gun was fired, the recoil swung it below the concrete parapet. After reloading, a counterweight was released to swing it back into firing position.



One of two 14' railway guns from Fort MacArthur in a practice firing at Point Don, near Oceanside, California, in June 1936. These guns fired 1,400-pound projectiles up tp 27 miles.

Fort MacArthur

From 1914 to 1974, Fort MacArthur was a U.S. Army coastal fortification guarding Los Angeles. It occupied a government reservation which had existed at the port of San Pedro since the mid 19th century. In 1914, the reservation was named in honor of Lieutenant General Arthur MacArthur, a military leader in the Spanish-American war, governor of the Philippines, and father of future General of the Army Douglas MacArthur. At that time, the fort comprised the original government reservation, later known as the Middle Reservation; an area on Point Fermin, later known as the Upper Reservation; and a small plot on Terminal Point. The fort later acquired property on Cabrillo Beach known as the Lower Reservation and at White Point and Point Vicente.

In 1917, the Army completed construction of four batteries of 14-inch disappearing carriage rifles and two batteries of 12-inch mortars on Point Fermin. The fort was then garrisoned by the **1st Coast Artillery Company, Fort MacArthur**, and, by 1918, by the **2nd and 3rd Companies of the Coast Defenses of Los Angeles**. During World War I, the fort guarded the harbor and served as a training and staging area for Army units departing for the European theater. More than 4,000 soldiers at one time were stationed at the fort before the end of the war.

Between World Wars, Fort MacArthur continued to guard the harbor. It was the headquarters of the **3rd Coast Artillery Regiment** from 1924 to 1944. The California National Guard trained there, and the Civilian Conservation Corps occupied its housing facilities. However, its armament grew increasingly outmoded in comparison to naval ordnance. In 1926 and 1930, the Army placed two modern 14-inch railway guns on the Middle Reservation, moving them to the Lower Reservation in 1936. Antiaircraft units augmented the fort's defenses in the 1930s, led by the **63rd Coast Artillery Regiment**, which made its headquarters at Fort MacArthur from 1930 to 1940.

During World War II, the fort maintained its defenses, trained artillerymen for service overseas, and processed soldiers entering and leaving military service. None of the large guns was fired at enemy targets, but a small gun shelled a suspected enemy submarine in the first month of the war. The armament was modernized again in 1944, when two 16-inch rifles were emplaced at White Point near the Upper Reservation. All of the major armament was inactivated and most of it sold for scrap between 1943 and 1948.

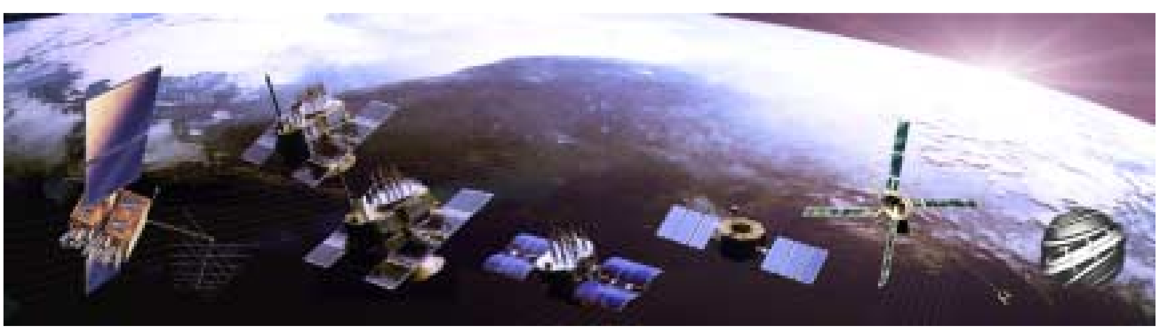
Fort MacArthur's mission changed radically after the war. In 1948, it became a major training center for Army reservists. In 1954, the fort became an antiaircraft missile site when a Nike Ajax missile battery was activated on the Upper Reservation. Fifteen other Nike sites were built in remote locations around southern California, all controlled by the **47th Artillery Brigade**, headquartered at Fort MacArthur until 1969, and later by the **19th Air Defense Artillery Group**. During 1958-1963, the Nike Ajax missiles were replaced by the more powerful Nike Hercules missiles, capable of carrying nuclear warheads.

By 1974, the Nike sites had become obsolete and were shut down. The Army retained the Middle Reservation as an administrative center for active and reserve Army and National Guard units, but it disposed of all other land attached to the fort. In 1978, the Army announced that it would declare Fort MacArthur as excess. The Air Force was then searching for a site to build housing for its Space Division, headquartered at Los Angeles AFB. The Department of Defense transferred Fort MacArthur to Air Force control on October 1, 1982, and Air Force families began moving into new housing that the Air Force had constructed.

: Launch of Nike Hercules missile at White Sands, New Mexico, probably in 1960s. Each missile was 40 feet long. It flew at Mach 3.65 to a range of 96.3 miles and an altitude of 100,000 feet. It carried one conventional or nuclear warhead detonated by ground command. Fort MacArthur's Nike Site LA-43 had 12 Nike Hercules missiles from 1963 to 1974.

Air Force Experimental Spacecraft and Satellites

Air Force Surveillance and Reconnaissance Satellites



Department of Defense Navigation Satellites